abdomen the appearance of a double row of tessellation on each side of the middle; the outer mark is bilobed, the lobes pointing backwards; the inner mark is more or less triangular, the apex pointing backwards. In none of my specimens is there any appearance of the fossette which Erichson uses as a character to divide the genus into two sections, according as the males have a fossette on the fourth segment or on the third and fourth segments of the abdomen.

The species is otherwise not difficult to distinguish. Its upper surface being concolorous reduces the number with which to compare it to a few; the ordinary proportions between the elytra and the thorax remove it from the Chilian species; and the double tessellation of the pubescence on each side of the abdomen distinguishes it from the Australian, Natal, and Siberian species.

If we except one or two of the species which are established and go everywhere in ships, the members of this genus do not appear to be so cosmopolitan as is generally supposed. At any rate, the other species come constantly from the countries to which they are ascribed.

[To be continued.]

IV.—*Remarks on the Potton Sands, in reply to Mr. Walker's Paper in the 'Annals of Natural History'* for November 1866. By Harry Govier Seeley, F.G.S., of the Woodwardian Museum in the University of Cambridge.

In July 1866 I wrote to the editors of this Magazine a letter on the fossils of the sands at Potton, expressing a few results of investigations into the nature of the sands between the Kimmeridge Clay and what are usually called the Middle Cretaceous beds*. My friend Mr. Walker, apparently misunderstanding my paper, and being zealous for the geological honour of our University, at once wrote a refutation of my mistakes, and published it in various sections of the British Association and in this Magazine. However, the only mistake in my letter was the statement that "*Gryphæa dilatata* is perversely wanting," which, indeed was then true; for before the end of July it occurred in great plenty, and was exhibited in the Woodwardian Museum.

* A portion of my results were given in a paper "On the Carstone and its Southern Extension," read in the Geological Section of the British Association at Nottingham; and the whole of them, with the method on which they depended, were given in a paper "On the Potton Sands," read before the Cambridge Philosophical Society, Nov. 12, 1866.

With this confession I now proceed to examine Mr. Walker's paper.

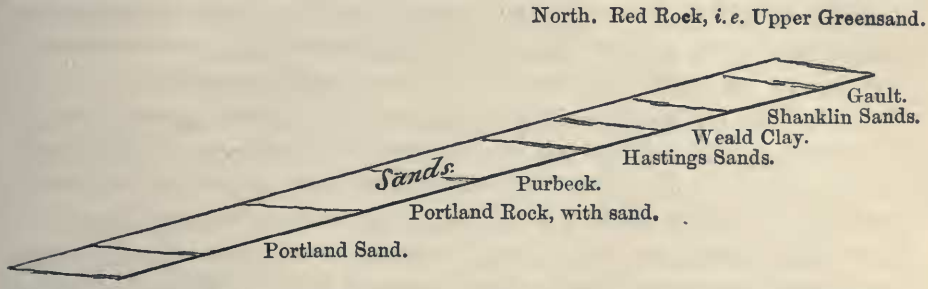
I. The deposit in which the phosphate-bed occurs he names the Lower Greensand. The Shanklin (or Lower Green) Sand, as I understand it, is the series of beds between the Weald Clay and the Gault. But these sands at Potton are between the Gault and the Oxford Clay; and, so far as I remember, the only fossil previously recorded from the beds in this district is *Ammonites biplex*, mentioned in my paper on the Cretaceous beds at Ely,—neither of which facts offers any presumptive evidence of the deposit being Shanklin Sands.

To assume the age is, no doubt, an easy way of settling an exceedingly complicated problem, and at the same time enables us to assert with confidence that all fossils except those previously found in similar deposits must be extraneous fossils, derived from the denudation of older beds, or, if need be, of newer ones. But even if the Potton Sands had been Lower Greensand, for which there is not an atom of evidence published, I am not aware that there would be anything more wonderful in the occurrence of *Gryphæa dilatata* in such a bed than there is in the occurrence of *Ammonites Lamberti*, a lower Oxfordian species, in the Kimmeridge Clay of Ely and in the Lower Greensand of Atherfield, or in the finding of the eminently Cretaceous *Neithea quinquecostata* in the Kimmeridge Clay of Weymouth.

II. A paragraph further on, Mr. Walker calls the phosphatic deposit a conglomerate. The idea conveyed by the term to most men who have seen conglomerates is a deposit formed by the wearing up of older strata into rounded masses, which have often become cemented together. But this Potton bed is a quantity of rolled concretions of tolerably pure phosphate of lime with a quantity of rolled masses of sand, sometimes concreted with phosphate of lime, sometimes with iron, rarely with silex, and a small proportion of old rocks: these are oftenest loose in sand, but sometimes bound into a hard mass by oxide of iron. The term conglomerate applied to this bed is calculated to mislead; for, involving the idea of denudation of older beds, these might furnish our author with his would-be extraneous fossils.

III. The author then questions my reference of this stratum to the *Carstone*. That name I have since proposed to restrict to the sands of Yorkshire, Lincolnshire, and Norfolk which occur between the Upper Greensand (Hunstanton Limestone) and the Kimmeridge Clay. But though I abandon the term, I do not abandon the idea; for what I wanted to express may be shown

by this diagram of the succession of sands in this part of our series of strata :—



In the south the sands pass insensibly down into the Kimmeridge Clay, in the north they rise insensibly up into the Upper Greensand; and the further one travels from the elevation of the Purbeck-Wealden area, the more thoroughly do those and all the cognate beds become represented by marine sands.

IV. What I meant by the deposit reproducing earlier in time the *conditions* of the Cambridge Greensand is not what our author is at such pains to show (that the Potton bed is sand, and does not effervesce with hydrochloric acid, while the Cambridge bed is a marl which does effervesce with hydrochloric acid), but that both were formed on a long low shore during a protracted period of time, that both derived their phosphoric acid from the growth and decay of sea-weed, that both were open to the actions which furnished the Greensand with its wonderful erratics*.

V. Our author then reminds us that in one analysis of a sample from this Potton phosphate bed there was as much as 6·64 per cent. of alumina, magnesia, and fluorine, and adds, "this would indicate that the phosphatic nodules had been formed of clay soaked in decomposing animal and vegetable matter." The author does not tell us whether this has been determined by experiment or evolved by some other method; but it is certainly a notable discovery that by soaking six or seven parts of alumina in decomposing animal and vegetable matter till they increase to 100, you will produce a nodule of *phosphate of lime*. What, meanwhile, would become of the clay, or in what reservoir all this soaking was to be done, are matters as to which we are left in ignorance.

VI. I am then criticised for saying that I had gathered no extraneous fossils from the bed. This, with diffidence, on account of the state of the specimens, I still repeat. And it is one of those things which have surprised me most; for I have

* See Geol. Mag. July 1866, "On the Cambridge Greensand."

long been in the habit of teaching that sands and sandstones are formed during upheaval, and therefore we may expect in them fossils denuded out of older strata; but we shall also almost inevitably have in the bed, of contemporary age, a mixture of the life of the preceding and of the succeeding periods*.

VII. The author then says that the phosphatic casts of shells in their general aspect resemble those of the Kimmeridge and Oxford Clays. Had he taken the trouble to get a few of them named, he would have found that they were Portland species; he would, moreover, have found that a large number of the casts are in sand cemented with phosphate of lime, and that species which are usually preserved as internal moulds occur with the shell preserved when contained in hard sandy nodules.

VIII. Many of the Mollusca, as Mr. Walker has stated, occur with the shell replaced by oxide of iron. They are all in exactly the same state of preservation; but since our author imagined the bed to be Shanklin Sand, he selects a few which have affinities with Lower Greensand species, and discards the remainder as extraneous—a way out of a difficulty, as I imagine, hardly in accordance with scientific method.

IX. Our author's list of Mollusca, as far as it goes, is given with some approach to correctness. I have seen no *Terebratula*, however, which corresponds with Prof. Morris's *celtica*. But *T. celtica*, *T. prælonga*, *T. sella*, *T. tamarindus*, and *T. depressa*, with some few others, will, I apprehend, hereafter be regarded as varieties of one species; so that it is one of those shells which it would not be surprising to find.

Pecten Robinaldinus is not a bad identification. But *P. Robinaldinus*, *P. interstriatus*, *P. Galliennei*, and several others are, I believe, only varieties of the *elongatus* of Lamarck, separated, like the Terebratulæ, because the series at the describer's command was too small to show the gradations of one form into another.

Ostrea macroptera.—Although this is the name used by me for this fossil, as a variety of the *O. frons* of Parkinson, it is a form limited, so far as I know, to the Portland Rock, being usually attached by the whole of one valve, and having the other valve nearly smooth—very unlike Sowerby's typical *O. macroptera*. *O. frons* and *O. gregaria* are not to be separated as species.

Pleurotomaria Deshayesii, though resembling that shell, is a variety of *P. gigantea*, intermediate between that species and *P. rugata*.

* "The Laws which have determined the Distribution of Life and of Rocks." Read before the Cambridge Philosophical Society, Nov. 12, 1866.

Not having seen Mr. Walker's specimens, I am unable to speak with confidence on the other species named; but no such shells as *Exogyra conica*, *Modiola æqualis*, and *Myacites plicata* have come under my notice, though I have long had other species of those genera in the Woodwardian Museum.

X. The author's list of fish and reptiles needs but brief comment, the names being in part identical with those which have for years been attached to similar fossils in the Woodwardian Museum; but it can hardly be necessary to assure any one that the genera *Pycnodus*, *Hybodus*, *Lepidotus*, *Gyrodus*, &c. are just as little found only in the Kimmeridge Clay as are the species *Asteracanthus ornatissimus* and *Lepidotus* (*Sphærodus*) *gigas*, and that there can be no reason for thinking them other than tenants of the sea of the time. Had the author availed himself more fully of the collections to which he appears to have had access, he might have chronicled a more wonderful series of fossils than those enumerated—a series as rich perhaps in genera and species of fossil reptiles as any known geological fauna.

XI. The author quotes the existence, in the Woodwardian Museum, of shelly limestone containing *Cyrenæ*, and uses this as evidence for inferring some of the fossils to have been derived from the Wealden. I can confidently say that no such specimens have ever been found; and the concretions which were supposed to be the said shelly limestone, on being broken, are found full of *Cardium*, *Cytherea*, &c. Moreover I have shown, in my paper on these beds, that the material of the deposit came from the east.

XII. Finally, Mr. Walker has described and figured (pl. 13) two shells. The one referred to *Sphæra Sedgwickii* is not a *Sphæra*, but a *Cyprina*, and only differs as a variety from *C. angulata* (Sow.), a type prolific in varieties. The form figured is not typical. The species referred to *Pholas Dallasii* may be new. As every one is aware, all the secondary *Pholades* belong to the genus *Pholadidea*. This species burrows in wood, and lines its burrow with shell, and rather approximates to *Xylophaga* and *Teredina* than to *Pholas*. It has no affinity to D'Orbigny's *P. Cornueliana*.

The age of the beds to which Mr. Walker's paper relates is a difficult problem, and not one that can be solved by an appeal to fossils, or mineral character, or superposition. And it is intimately bound up with questions of great interest, such as the age of the Farringdon beds and the nature of the marine equivalents of the Purbeck and Wealden strata. For I have found to the north of Cambridge most of the Farringdon fossils in a

bed inseparable by any great distinction from, and under, sands full of the Potton-Sand fossils*.

A discussion of the whole question and descriptions of the fossils are given in my 'Geology of the Country round Cambridge.' It may be here stated that this investigation led to proposing the following classification of the secondary strata:—

Cretaceous...	Chalk. Greensand. Gault.
Psammolithic (or Siliceous)	Shanklin (or Lower Green) Sand. Wealden Purbeck Portland.
Wealden	Potton? and Wicken and Farringdon beds?
Pelolithic (or Felspathic)...	Kimmeridge Clay. Coral Rag and Gamlingay Clay. Oxford Clay.
Oolitic	Great Oolite. Inferior Oolite.
	Lias.
	Trias.

While these divisions mark approximately the greater physical breaks and the periods when great changes were made in physical geography, it happens almost as a necessary consequence that there is a linking of the life between each of the six great groups of formations here indicated.

V.—*Remarks on* Pyrula (Fulgur) carica (*Lamarck*) *and* Pyrula (Fulgur) perversa (*Lamarck*). By T. Graham Ponton.

Although fully alive to the responsibility which rests upon any one who presumes to doubt the specific value of old and well-known forms, I nevertheless venture to submit the few following remarks to the consideration of other conchologists.

Having for some time past been engaged in re-arranging the collection of shells in the museum of this city, and having paid particular attention to the species comprised in the Lamarckian genus *Pyrula*, I have reluctantly come to the conclusion, for reasons to be afterwards mentioned, that *Pyrula perversa* (La-

* At the meeting of the Cambridge Philosophical Society, May 27, 1867, a paper was read "On the association of Potton-Sand fossils with those of the Farringdon Gravels in a phosphatic deposit at Upware on the Cam; with an account of the superposition of the beds, and the significance of the affinities of the fossils." This series I propose to name the Wicken and Herrimere group. I have already obtained 120 species, including many continental species not previously recorded in Britain.